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ART UNIT	**PAPER NUMBER**
2882	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/810,828	Applicant(s) ZARRABIAN ET AL.	
	Examiner Thomas R Artman	Art Unit 2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondenc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 23 December 2002 .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-16 and 26-31 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-16 and 26-31 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Response to Amendment

The examiner acknowledges the cancellation of claims 17-25 by the applicant, drawn to a non-elected invention, in the amendment filed December 4th, 2002, in Paper No.7.

Response to Arguments

Based upon the testimony of Dr. Robert Klinger, the examiner withdraws the objection to the specification regarding the thermal expansion property units. The examiner recognizes that ppm/^{0}C are appropriate units commonly used in the art to describe the thermal sensitivity of an optical filter in a form that is independent of the illumination wavelength(s). The examiner also withdraws the claim objections against claims 6-8, 11 and 14 for the same reason.

In light of the applicant's arguments, the examiner withdraws all prior art combination rejections based upon the Kash (US 5,343,542) reference that were made in the previous Office Action, dated the 28th of August, 2002, of Paper No.6.

Applicant's arguments with respect to claims 1-16 and 26 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Russell (US 6,151,114) and in view of Cao (US 6,130,971).

Regarding both claims, Russell's bandpass spatial filter (Fig.1) has most of the recited structure, including:

1) a linear variable filter (item 18) having an etalon structure with a tapered spacer region (item 24) disposed along a taper direction, and

2) a linear optical detector array disposed along the taper direction and is affixed to the linear variable filter.

Russell does not disclose a fiber optic input and collimating optics. However, Fig.1 shows collimated incident light onto the filter.

Cao discloses a multiplexer/demultiplexer (Fig.4) with a fiber optic input (item 410) mated with collimating optics (item 450) as part of a fiber optic communication system. Though Russell's device is not specifically used for fiber optic communications, Russell's invention is an analyzer for a laser warning system. As is known in the art, a sensor portion is typically located remotely from analyzer and computational tools. This is often practiced for improved thermal stability, vibration suppression, etc., and particularly when the sensor portion

is in a harsh environment or in a location where physical space is at a premium. A fiber optic cable would be required to run from the remote sensor portion to Russell's bandpass spatial filter as part of a fiber optic communication system between many remote sensors and analyzers and computational tools.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include an input optical fiber and the necessary collimating optics in order to link Russell's bandpass spatial filter to a remote sensor portion of the warning system. As shown in Fig.1, item 10, of Russell, the light is collimated. As is known in the art, incident light that is at an angle will cause an effective thickness change to the light beam. This effect is advantageously used by rotating traditional etalons with parallel mirrors to effect a shift in the filter's bandwidth. This would be detrimental to a wedge etalon, whose precise angle between the mirrors dictates the necessary bandwidth. Furthermore, if this device were to be used as a demultiplexing device in a fiber optic communication system, then it must be mated with a fiber optic input for ease of integration with the standard optical communication technology.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Russell and Cao, and in view of Gat (US 5,166,755).

Russell and Cao do not disclose or teach the use of magnification optics in conjunction with a collimating lens. Gat discloses the use of magnification optics for use in his optical spectrometer. In this way, the entire wedge etalon is illuminated such that the entire spectral range of the spectrometer is used for accurate determination of the entire sample spectrüm desired.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a magnification lens within collimating optics such that the divergent beam from the optical fiber is sized and conditioned for proper illumination of the entire wedge etalon filter.

Claims 3-4, 6-8, 10 and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Russell and Cao, and in view of Gaebe (US 6,278,549).

Regarding claims 3 and 4, Russell and Cao do not disclose or teach of the use of multilayered mirrors in an etalon structure that are alternating in refractive index where some of the layers are made of silicon dioxide or a spacer layer made of the same. Russell does state, however, that his tapered spacer layer (Fig.1, item 24) is made of an optically transparent material.

Gaebe discloses an etalon structure (Fig.1) with multilayered mirror structures (items 130 and 132) that alternate between silicon dioxide and tantalum pentoxide (col.3, lines 1-9, as well as col.1, lines 21-26 and lines 35-40). Though the exact composition of the spacer layer (item 125) is not specified, it is understood that all the layers deposited are comprised of either one or the other of the above stated materials. Therefore, Gaebe suggests the use of silicon dioxide as an appropriate spacer layer. As is commonly known in the art, the use of such dielectric layers for multilayer mirrors allows more precise tuning of the device's transmission/reflection characteristics for a given bandwidth by alternating indices of refraction and modifying film

thicknesses. Furthermore, the combination of materials and substrate of Gaebe provides significant improvement in thermal stability as well as improved band-edge behavior.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use multilayered mirrors of silicon dioxide and tantalum pentoxide for improved band-edge behavior and improved thermal stability.

Regarding claims 6-8, Russell and Cao do not disclose specific thermal stabilities. Gaebe discloses in Fig.4 that his structure performs with thermal stabilities around center wavelengths within the optical communication range (also within the range of Russell, see col.4, lines 10-11) that correspond to being less than 25 parts per million per degree Centigrade. This falls within the range of being less than 50, and a stability less than 10 falls within the range of being less than 25 parts per million per degree Centigrade. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have such low thermal stabilities such that the device operates more reliably without many calibrations or the need for motion-based servo thermal compensators that require more maintenance and are more expensive.

Regarding claim 10, though Russell and Cao do not disclose band-edge filters specifically, Russell discloses that proper design can approach the ideal band-edge, square-shaped transmission characteristic as illustrated in Fig.5. Furthermore, Gaebe states, in col.1, lines 35-40, that the judicious selection of materials and film thicknesses allows a more narrow bandwidth, which one skilled in the art would recognize as approaching the ideal filter, one that would exhibit band-edge, or square-edged, transmission characteristics of a specific range. It

would have been obvious to one of ordinary skill in the art at the time the invention was made to use a band-edge filter as reasonably taught by Russell and Gaebe for further improved spectrum resolution.

Regarding claim 27, Russell discloses a tapered linear variable bandpass filter with a linear optical detector array disposed along the taper direction, where the incident light upon the filter is collimated.

Cao discloses the use of a fiber optic input mated with collimating optics as a method for illuminating Russell's device with the light to be analyzed.

Gaebe discloses an etalon filter with a mirror, spacer and substrate combination that has a thermal stability less than 50 parts per million per degree Centigrade.

Therefore, as discussed in detail above against claims 1-2 and 6-8, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a fiber optic input mated with the necessary collimating optics in order to properly illuminate the etalon structure, and it would also have been obvious at the time the invention was made to design the filter to have a thermal stability less than 50 parts per million per degree Centigrade such that less maintenance, as well as fewer parts, are needed.

With respect to claim 28, as argued above against claim 10, Russell and Gaebe teach the desired bandwidth filter properties of approaching the ideal, "band-edge" transmission characteristics, and therefore, it would have been obvious to one of ordinary skill in the art at the

time the invention was made to use a band-edge filter as reasonably taught by Russell and Gaebe for further improved spectrum resolution.

Regarding claim 29, Russell discloses a tapered linear variable bandpass filter with a linear optical detector array disposed along the taper direction, where the incident light upon the filter is collimated.

Cao discloses the use of a fiber optic input mated with collimating optics as a method for illuminating Russell's device with the light to be analyzed.

Further, as argued above against claim 10, Russell and Gaebe teach the desired bandwidth filter properties of approaching the ideal, "band-edge" transmission characteristics.

Therefore, as discussed in detail above against claims 1-2 and 10, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a fiber optic input mated with the necessary collimating optics in order to properly illuminate the etalon structure, and it would also have been obvious at the time the invention was made to use a band-edge filter as reasonably taught by Russell and Gaebe for further improved spectrum resolution.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Russell and Cao and Gaebe, and in further view of AAPA (Applicant's Admission of Prior Art).

The structure as applied above against claim 3 applies here and the following. Gaebe discloses that silicon dioxide, tantalum pentoxide, or other suitable dielectric materials could be successfully used (col.3, lines 7-9). The Applicant states, on p.5, lines 33-34, that well-known

materials include niobium pentoxide as well as tantalum pentoxide as a high refractive index layer partnered with materials such as silicon dioxide for the low refractive index layer.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use niobium pentoxide as a "suitable dielectric material" for use as high refractive index layers with silicon dioxide in multilayered mirrors in an etalon structure. This provides improved filter performance and discussed in the rejection of claim 3 above, as an alternative, successful substitute for tantalum pentoxide.

Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Russell, Cao, Gat and Gaebe.

Regarding claim 11, Russell discloses a tapered linear variable bandpass filter with a linear optical detector array disposed along the taper direction, where the incident light upon the filter is collimated.

Cao discloses the use of a fiber optic input mated with collimating optics as a method for illuminating Russell's device with the light to be analyzed. Further, Gat discloses the advantageous use of magnification optics for attaining proper beam size for illumination of a linear variable spectrometer.

Gaebe discloses an etalon filter with a mirror, spacer and substrate combination that has a thermal stability less than 50 parts per million per degree Centigrade.

Therefore, as discussed in detail above against claims 1-2 and 6-8, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a fiber optic

input mated with the necessary magnification and collimating optics in order to properly illuminate the etalon structure, and it would also have been obvious at the time the invention was made to design the filter to have a thermal stability less than 50 parts per million per degree Centigrade such that less maintenance, as well as fewer parts, are needed.

With respect to claim 12, though Russell does not specifically disclose the length of his optical detector array, he does state that the length of his filter is about one quarter of an inch, or less than 10mm. Given the fact that the output interference pattern of the filter (Fig.1, item 28) is not significantly longer than the length of the taper direction of the filter when illuminated with collimated light as shown, any detector pixels extending beyond 10mm is a waste. It would have been obvious to one of ordinary skill in the art at the time the invention was made to readily refer to a catalogue and select from the many sizes, configurations and resolutions, the optical detector array that would best suit his invention. At the time the invention was made, optical detector arrays of about 12mm were available with very high resolution and tight pixel spacing.

Claims 13-16, 26 and 30-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Russell, Cao, Gat and Gaebe, and in view of Takashashi (Applied Optics, vol.34, No.4, pp.667-675).

With respect to claim 13, the structure as applied above against claim 11 applies here and the following. None of the above references characterize their devices as having a FWHM of less than or equal to about 0.6nm around a center wavelength within the typical optical communication bandwidth. Takashashi discloses, on p.670, Table 3, that a multilayer cavity

combination similar to the one used by Gaebe has a FWHM of 0.5nm within the optical communication bandwidth.

It would have been obvious to one of ordinary skill in the art at the time the invention was made that Gaebe's tantalum pentoxide/silicon dioxide multilayer mirror/cavity combination would inherently be capable of having a similar characteristic that would fall within the specified range.

Regarding claims 14 and 26, Russell discloses a tapered linear variable bandpass filter with a linear optical detector array disposed along the taper direction and an analyzer to monitor the output, where the incident light upon the filter is collimated. Further, as argued above in the rejection of claim 12, the linear optical array need not be longer than the length of the taper direction of the filter.

Cao discloses the use of a fiber optic input mated with collimating optics as a method for illuminating Russell's device with the light to be analyzed. Further, Gat discloses the advantageous use of magnification optics for attaining proper beam size for illumination of a linear variable spectrometer.

Gaebe discloses an etalon filter with a mirror, spacer and substrate combination that has a thermal stability less than 50 parts per million per degree Centigrade. Further, Gaebe's multilayer structure further satisfies the limitation of having a FWHM of less than or equal to about 0.6nm around a center wavelength within the typical optical communication bandwidth (1530-1600) nm, as discussed above in the rejection of claim 13, referring to Takashashi.

Therefore, as argued above against claims 1-2, 6-8 and 12-13, it would have been obvious to one of ordinary skill in the art at the time the invention was made to:

1) use a fiber optic input mated with the necessary magnification and collimating optics in order to properly illuminate the etalon structure,

2) use a multilayered mirror/spacer material structure as taught by Gaebe with the above stated properties for improved thermal stability, and

3) readily refer to a catalogue and select from the many sizes, configurations and resolutions, the optical detector array that would best suit the dimensions and resolution requirements of the filter.

Further regarding claim 26, Cao discloses optical fiber inputs that handle optical information with channel spacing far smaller than 200GHz. It would have been obvious to one of ordinary skill in the art at the time the invention was made that a linear variable filter with Russell's taper direction length and all of the prior art structure as combined above can spectrally resolve such an optical data stream.

With respect to claims 15-16, it would have been obvious to one of ordinary skill in the art at the time the invention was made that detector arrays with pixel densities higher than those claimed existed commercially. One skilled in the art would readily refer to a catalogue and select from the many sizes, configurations and resolutions, the optical detector array that would best suit the dimensions and resolution requirements of the filter.

Regarding claim 30, Russell discloses a tapered linear variable bandpass filter with a linear optical detector array disposed along the taper direction and an analyzer to monitor the output, where the incident light upon the filter is collimated.

Cao discloses the use of a fiber optic input mated with collimating optics as a method for illuminating Russell's device with the light to be analyzed. Also, Cao discloses optical fiber inputs that handle optical information with channel spacing far smaller than 200GHz, and an optical tap (Fig.1) from the same DWDM optical fiber communication system.

Gaebe discloses an etalon filter with a mirror, spacer and substrate combination that has a thermal stability less than 50 parts per million per degree Centigrade. Further, Gaebe's multilayer structure further satisfies the limitation of having a FWHM of less than or equal to about 0.6nm around a center wavelength within the typical optical communication bandwidth (1530-1600) nm, as discussed above in the rejection of claim 13, referring to Takashashi.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to:

1) use a fiber optic input mated with the necessary collimating optics in order to properly illuminate the etalon structure,

2) use a mirror, spacer and substrate combination as taught by Gaebe with the above stated properties for improved thermal stability, and

3) to analyze at least a portion of a data stream tapped from a WDM optical fiber communication system with the prior art combination as described above for improved optical signal demultiplexing.

With respect to claim 31, it would have been obvious to one of ordinary skill in the art at the time the invention was made that any analog optical detector would be mated with an analog-to-digital converter in order to take advantage of the digital computer analyzing technology.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas R Artman whose telephone number is (703) 305-0203. The examiner can normally be reached on 8am - 5:30pm Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim can be reached on (703) 305-3492. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1782.

TRA
January 29, 2003

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